| **Grade** | **Big Idea** | **Essential Questions** | **Concepts** | **Competencies** | **Vocabulary** | **Standard** | **Eligible Content** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PreK-2** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions arise from direct involvement with the material world, classroom interactions, written materials and observed phenomena. | Ask questions about the natural and human-made world, including objects, organisms, or events in the environment. | Question  Object  Organism  Events  Environment  Interaction  Material  Phenomena  Human-made  Natural |  | S4.A.2.1.1 |
| **PreK-2** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Scientists review and ask questions about the results or other scientists' work. | Ask questions to decipher similarities and differences in patterns. | Question  Decipher  Similarities  Patterns |  | S4.A.2.1.4 |
|  |  |  |  |  |  |  |  |
| **3-4** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions arise from direct involvement with the material world, classroom interactions, written materials and observed phenomena. | Ask questions about the natural and human-made world, including objects, organisms, or events in the environment. | Questions  Material World  Interactions  Observe  Phenomena  Organisms  Human-made  Events |  | S4.A.2.1.4 |
| **3-4** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Scientists review and ask questions about the results or other scientists' work. | Ask questions to decipher similarities and differences in patterns. | Question  Decipher  Similarities  Patterns |  | S4.A.2.1.4 |
|  |  |  |  |  |  |  |  |
| **5-6** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions arise from direct involvement with the material world, classroom interactions, written materials and observed phenomena. | Identify questions and concepts that can be investigated scientifically. | Questions  Concepts  Investigate  Interactions  Phenomena |  | S8.A.1.1 |
| **5-6** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions can be crafted to provide direction and insight for construction of pragmatic solutions. | Formulate and refine questions that can be answered empirically. | Formulate  Empirical  Solution |  | S8.A.1.1 |
| **5-6** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Investigations involve asking and answering questions and comparing answers with what scientists already know about the world. | Formulate and refine questions that can be answered empirically. | Empirical  Question  Refine  Formulate  Investigate |  | S8.A.1.1 |
| **5-6** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Scientists usually inquire about how physical, living or designed systems function. | Formulate and refine questions that can be answered empirically. | Empirical  Designed System |  | S8.A.1.1 |
|  |  |  |  |  |  |  |  |
| **7-8** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions arise from direct involvement with the material world, classroom interactions, written materials and observed phenomena. | Identify questions and concepts that can be investigated scientifically. | Concepts  Interactions  Phenomena |  | S8.A.1.1 |
| **7-8** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions can be crafted to provide direction and insight for construction of pragmatic solutions. | Formulate and refine questions that can be answered empirically. | Formulate  Empirical  Solution |  | S8.A.1.1 |
| **7-8** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Investigations involve asking and answering questions and comparing answers with what scientists already know about the world. | Formulate and refine questions that can be answered empirically. | Formulate  Empirical  Solution |  | S8.A.1.1 |
| **7-8** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Scientists usually inquire about how physical, living or designed systems function. | Formulate and refine questions that can be answered empirically. | Physical System  Designed System |  | S8.A.1.1 |
|  |  |  |  |  |  |  |  |
| **9-12** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions arise from direct involvement with the material world, classroom interactions, written materials and observed phenomena. | Formulate probing questions that seek to identify the basis of an argument, further the elaboration, or challenge a data-based interpretation. | Data-based Interpretation |  |  |
| **9-12** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions provide direction and insight for further investigation. | Formulate probing questions that seek to identify the basis of an argument, further the elaboration, or challenge a data-based interpretation. | Argument  Data-based Interpretation |  |  |
| **9-12** | Asking questions, which arise in a variety of ways, is essential to developing scientific habits of mind. | What kinds of questions do scientists ask? | Questions are essential for clarifying the design, the purpose and the interpretation of investigations. | Formulate probing questions that seek to identify the basis of an argument, further the elaboration, or challenge a data-based interpretation. | Argument  Data-based Interpretation |  |  |
|  |  |  |  |  |  |  |  |
| **PreK-2** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | As tools of science, models are based on evidence. | Devise pictorial and simple graphical representations of the findings in investigations and use these models in developing explanations. | Pictorial  Graphical  Representation  Model  Tools of Science |  | S4.A.3.1  S4.A.3.2 |
|  |  |  |  |  |  |  |  |
| **3-4** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | As tools of science, models are based on evidence. | Devise pictorial and simple graphical representations of the findings in investigations and use these models in developing explanations. | Pictorial  Graphical  Representation  Model  Tools of Science |  | S4.A.3.1  S4.A.3.2 |
|  |  |  |  |  |  |  |  |
| **5-6** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Scientists construct models of phenomena. | Construct scale drawings or diagrams to represent objects, events, or systems. | Model  Diagram  Events  Systems  Phenomena |  | S8.A.3.2 |
| **5-6** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can change. | Refine a model in light of empirical evidence or criticism to improve its quality. | Empirical  Criticism  Model |  | S8.A.3.2 |
| **5-6** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Construct and use a model to test a design, or aspects of a design or system. | Model  Design  System  Mathematical  Technological  Physical  Conceptual |  | S8.A.3.2 |
| **5-6** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Select and use simulations (simple, computer, or otherwise) to understand and investigate aspects of a system. | Simulation  Model  Physical  Conceptual  Mathematical  Technological |  | S8.A.3.2 |
|  |  |  |  |  |  |  |  |
| **7-8** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Scientists construct models of phenomena. | Construct scale drawings or diagrams to represent objects, events, or systems. | Scale  Diagram  Events  System  Phenomena |  | S8.A.3.2 |
| **7-8** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can change. | Refine a model in light of empirical evidence or criticism to improve its quality. | Model  Empirical  Evidence  Criticism |  | S8.A.3.2 |
| **7-8** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Construct and use a model to test a design, or aspects of a design or system. | Model  Design  System  Physical  Mathematical  Technological |  | S8.A.3.2 |
| **7-8** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Select and use simulations (simple, computer, or otherwise) to understand and investigate aspects of a system. | Simulation  Physical  Conceptual  Mathematical  Technological  Model  System |  | S8.A.3.2 |
|  |  |  |  |  |  |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | As tools of science, models are based in evidence. | Formulate scientific explanations and models using logic and evidence. | Scientific Explanation  Logic  Evidence  Model  Tools of Science |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can change. | Refine a model in light of empirical evidence or criticism to improve its quality and explanatory power. | Model  Empirical |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can change. | Discuss the limitations and precision of a model as the representation of a system, process, or design. | Limitation  Precision  System  Design  Model |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Recognize and analyze alternative explanations and models. | Alternative Explanation  Model  Physical  Mathematical  Technological |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Formulate scientific explanations and models using logic and evidence. | Model  Physical  Mathematical  Technological |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Use simulations (simple, computer, or otherwise) to understand and investigate aspects of a system. | Model  Physical  Mathematical  Technological |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Make and use models to test a design, or aspects of a design, and to compare the effectiveness of different design solutions. | Model  Physical  Mathematical  Technological  Effectiveness |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Make and use models to test a design, or aspects of a design, and to compare the effectiveness of different design solutions. | Model  Physical  Mathematical  Technological  Effectiveness |  |  |
| **9-12** | Scientists use models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How do scientists develop and use models? | Models can be physical, conceptual, mathematical, or technological. | Observe and communicate using complete, accurate and detailed descriptions. | Model  Physical  Mathematical  Technological |  |  |
|  |  |  |  |  |  |  |  |
| **PreK-2** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Inquiry involves asking a simple question, completing an investigation, answering the question and presenting the results to others. | Plan and conduct a simple investigation. | Investigation  Question  Results |  | S4.A.2.1  S4.A.2.2 |
| **PreK-2** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientists use different kinds of investigations depending on the questions they are trying to answer. | Employ simple equipment and tools to gather data and extend the senses. | Equipment  Investigation  Question  Data |  | S4.A.2.1  S4.A.2.2 |
| **PreK-2** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Experiments are guided by concepts and are performed to test ideas. | Employ simple equipment and tools to gather data and extend the senses. | Equipment  Data  Tools  Experiment  Concepts |  | S4.A.2.1  S4.A.2.2 |
| **PreK-2** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientific investigations are conducted in a variety of arenas. | Employ simple equipment and tools to gather data and extend the senses. | Equipment  Data  Investigation |  | S4.A.2.1  S4.A.2.2 |
|  |  |  |  |  |  |  |  |
| **3-4** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Inquiry involves asking a simple question, completing an investigation, answering the question and presenting the results to others. | Plan and conduct a simple investigation. | Inquiry  Investigation  Plan  Results |  | S4.A.2.1  S4.A.2.2 |
| **3-4** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientists use different kinds of investigations depending on the questions they are trying to answer. | Employ simple equipment and tools to gather data and extend the senses. | Equipment  Tools  Data  Investigation |  | S4.A.2.1  S4.A.2.2 |
| **3-4** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Experiments are guided by concepts and are performed to test ideas. | Employ simple equipment and tools to gather data and extend the senses. | Equipment  Tools  Data  Investigation |  | S4.A.2.1  S4.A.2.2 |
| **3-4** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientific investigations are conducted in a variety of arenas. | Employ simple equipment and tools to gather data and extend the senses. | Equipment  Tools  Data  Investigation |  | S4.A.2.1  S4.A.2.2 |
|  |  |  |  |  |  |  |  |
| **5-6** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Inquiry involves asking a simple question, completing an investigation, answering the question and presenting the results to others. | Formulate a question that can be investigated with available resources and, when possible, frames a hypothesis based on a model or theory. | Question  Inquiry  Resources  Hypothesis  Model  Theory  Results |  | S8.A.2.1  S8.A.2.2 |
| **5-6** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientists use different kinds of investigations depending on the questions they are trying to answer. | Design and conduct a fair test identifying relevant independent and dependent variables and, when appropriate, the need for controls. | Fair Test  Controls  Variables  Independent Variable  Dependent Variable |  | S8.A.2.1  S8.A.2.2 |
| **5-6** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Experiments are guided by concepts and are performed to test ideas. | Use appropriate tools and techniques to gather, analyze, and interpret data. | Tools  Techniques  Analyze  Interpret  Data |  | S8.A.2.1  S8.A.2.2 |
| **5-6** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientific investigations are conducted in a variety of arenas. | Use appropriate tools and techniques to gather, analyze, and interpret data. | Tools  Techniques  Analyze  Interpret  Data |  | S8.A.2.1  S8.A.2.2 |
| **5-6** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Historic and current scientific knowledge influence the design of experiments. | Use appropriate tools and techniques to gather, analyze, and interpret data. | Tools  Techniques  Analyze  Interpret  Data |  | S8.A.2.1  S8.A.2.2 |
|  |  |  |  |  |  |  |  |
| **7-8** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Inquiry involves asking a simple question, completing an investigation, answering the question and presenting the results to others. | Formulate a question that can be investigated with available resources and, when possible, frames a hypothesis based on a model or theory. | Hypothesis  Model  Theory |  | S8.A.2.1  S8.A.2.2 |
| **7-8** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientists use different kinds of investigations depending on the questions they are trying to answer. | Design and conduct a fair test identifying relevant independent and dependent variables and, when appropriate, the need for controls. | Fair Test  Controls  Independent Variable  Dependent Variable |  | S8.A.2.1  S8.A.2.2 |
| **7-8** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Experiments are guided by concepts and are performed to test ideas. | Use appropriate tools and techniques to gather, analyze, and interpret data. | Tools  Analyze  Data |  | S8.A.2.1  S8.A.2.2 |
| **7-8** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientific investigations are conducted in a variety of arenas. | Use appropriate tools and techniques to gather, analyze, and interpret data. | Tools  Analyze  Data |  | S8.A.2.1  S8.A.2.2 |
| **7-8** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Historic and current scientific knowledge influence the design of experiments. | Use appropriate tools and techniques to gather, analyze, and interpret data. | Tools  Analyze  Data |  | S8.A.2.1  S8.A.2.2 |
|  |  |  |  |  |  |  |  |
| **9-12** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Inquiry involves asking a simple question, completing an investigation, answering the question and presenting the results to others. | Design and conduct a scientific investigation identifying relevant independent and dependent variables and, when appropriate, the need for controls. | Scientific Investigation  Independent Variable  Dependent Variable |  |  |
| **9-12** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientists use different kinds of investigations depending on the questions they are trying to answer. | Consider possible confounding variables or effects and ensure that the design of the investigation has controlled for them. | Design of Investigation |  |  |
| **9-12** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Experiments are guided by concepts and are performed to test ideas. | Decide how much data are needed to produce reliable measurements and consider any limitations on the precision of the data. | Limitations  Precision |  |  |
| **9-12** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Historic and current scientific knowledge influence the design of experiments. | Decide how much data are needed to produce reliable measurements and consider any limitations on the precision of the data. | Reliable  Limitations  Precision |  |  |
| **9-12** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Hypotheses should be based on a well developed theory or model. | Decide how much data are needed to produce reliable measurements and consider any limitations on the precision of the data. | Reliable  Precision  Theory  Model  Hypothesis |  |  |
| **9-12** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Scientific investigations are conducted in a variety of arenas. | Decide how much data are needed to produce reliable measurements and consider any limitations on the precision of the data. | Reliable  Precision |  |  |
| **9-12** | Investigations are designed and implemented either to systematically describe the world or to develop and test theories and explanations of how the world works. | How do scientists find out more about our world and how it functions? | Results of scientific inquiry - new knowledge and methods - emerge from different kinds of investigations. | Decide how much data are needed to produce reliable measurements and consider any limitations on the precision of the data. | Reliable  Limitations  Precision |  |  |
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| **PreK-2** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Evidence can come from individual investigations, other peoples' investigations, or databases. | Construct and interpret number or picture graphs and tables. | Interpret  Graphs  Tables |  | S4.A.2.1  S4.A.1.1 |
| **PreK-2** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Data is collected and analyzed to help validate or improve a design or decide on an optimal solution. | Collect categorical and numerical data for presentation in forms that facilitate interpretation (tables and graphs). | Data  Interpretation |  | S4.A.2.1  S4.A.1.1 |
| **PreK-2** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Data is collected and analyzed to help validate or improve a design or decide on an optimal solution. | Recognize patterns in relationships. | Pattern  Solution |  | S4.A.2.1  S4.A.1.1 |
|  |  |  |  |  |  |  |  |
| **3-4** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Evidence can come from individual investigations, other peoples' investigations, or databases. | Construct and interpret number or picture graphs and tables. | Graphs  Tables |  | S4.A.2.1  S4.A.1.1 |
| **3-4** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Data is collected and analyzed to help validate or improve a design or decide on an optimal solution. | Collect categorical and numerical data for presentation in forms that facilitate interpretation (tables and graphs). | Data  Interpretation  Tables  Graphs |  | S4.A.2.1  S4.A.1.1 |
| **3-4** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Data is collected and analyzed to help validate or improve a design or decide on an optimal solution. | Recognize patterns in relationships. | Patterns  Relationships |  | S4.A.2.1  S4.A.1.1  S4A.3.1  S4.A.3.3 |
|  |  |  |  |  |  |  |  |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Evidence can come from individual investigations, other students' investigations, or databases. | Review data from a simple experiment, summarize the data, and form a logical argument about the cause-and-effect relationships in the experiment. | Data  Summarize  Cause-and-Effect Relationships |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Analysis of data brings out meaning and relevance so they can be used as evidence. | Recognize patterns in data that suggest relationships worthy of further investigation. | Patterns  Relationships  Relevance |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Analysis of data bring out meaning and relevance so they can be used as evidence. | Evaluate the strength of a conclusion that can be interpreted from any data set, using grade-appropriate mathematical techniques. | Interpret  Data  Analysis |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Analysis of data bring out meaning and relevance so they can be used as evidence. | Analyze the performance of a design under a range of conditions. | Design  Conditions  Relevance  Analysis |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Spreadsheets and databases provide useful ways of organizing data. | Use databases, tables, charts, graphs, mathematics, and information and computer technology to collate, summarize and display data and to explore relationships between variables. | Database  Tables  Charts  Graphs  Summarize  Variables  Spreadsheets |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Scientists rely on technology to enhance the gathering and manipulation of data. | Use databases, tables, charts, graphs, mathematics, and information and computer technology to collate, summarize and display data and to explore relationships between variables. | Database  Tables  Charts  Graphs  Summarize  Variables  Spreadsheets |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Data is collected and analyzed to help validate or improve a design or decide on an optimal solution. | Recognize when data are in conflict with expectations and consider what revisions in the initial model are needed. | Model |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Historical and current scientific knowledge influence the interpretation of investigations. | Recognize when data are in conflict with expectations and consider what revisions in the initial model are needed. | Model |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **5-6** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | There is often more than one way to display data in order to identify and present significant features. | Utilize standard techniques for displaying, analyzing, and interpreting data (different types of graphs, identification of outliers, averaging). | Analyze  Display  Interpret  Data |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
|  |  |  |  |  |  |  |  |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Evidence can come from individual investigations, other students' investigations, or databases. | Review data from a simple experiment, summarize the data, and form a logical argument about the cause-and-effect relationships in the experiment. | Evidence  Summarize  Cause-and-Effect Relationship |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Analysis of data bring out meaning and relevance so they can be used as evidence. | Recognize patterns in data that suggest relationships worthy of further investigation. | Pattern  Relationships |  |  |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Analysis of data bring out meaning and relevance so they can be used as evidence. | Evaluate the strength of a conclusion that can be interpreted from any data set, using grade-appropriate mathematical techniques. | Conclusion  Analysis  Evidence |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Analysis of data bring out meaning and relevance so they can be used as evidence. | Analyze the performance of a design under a range of conditions. | Design  Conditions |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Spreadsheets and databases provide useful ways of organizing data. | Use databases, tables, charts, graphs, mathematics, and information and computer technology to collate, summarize and display data and to explore relationships between variables. | Database  Table  Chart  Graphs  Relationship  Spreadsheet  Database |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Scientists rely on technology to enhance the gathering and manipulation of data. | Use databases, tables, charts, graphs, mathematics, and information and computer technology to collate, summarize and display data and to explore relationships between variables. | Database  Table  Chart  Graphs  Relationship  Spreadsheet  Database |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Data is collected and analyzed to help validate or improve a design or decide on an optimal solution. | Recognize when data are in conflict with expectations and consider what revisions in the initial model are needed. | Model  Design |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Historical and current scientific knowledge influence the interpretation of investigations. | Recognize when data are in conflict with expectations and consider what revisions in the initial model are needed. | Mdoel |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
| **7-8** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | There is often more than one way to display data in order to identify and present significant features. | Utilize standard techniques for displaying, analyzing, and interpreting data (different types of graphs, identification of outliers, averaging). | Analyze  Interpret  Data |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.2 |
|  |  |  |  |  |  |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Evidence can come from individual investigations, other students' investigations, or databases. | Recognize and analyze alternative explanations and models to decide which are best suited for a given set of data. | Alternative Explanation  Model |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Analysis of data brings out their meaning and relevance so that they can be used as evidence. | Distinguish between causal and correlational relationships. | Causal Relationship  Correlational Relationship |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Scientists rely on technology to enhance the gathering and manipulation of data. | Analyze data systematically to see whether they are consistent with an initial hypothesis. | Systematically |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Spreadsheets and databases provide useful ways of organizing data. | Use spreadsheets, databases, tables, charts, graphs, statistics, mathematics, and information and computer technology to collate, summarize, and display data and to explore relationships between variables. | Spreadsheet  Database  Table  Chart  Statistics  Relationships |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Historical and current scientific knowledge influence the interpretation of investigations. | Evaluate the strength of a conclusion that can be interpreted from any data set, using grade-appropriate mathematical techniques. | Conclusion |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | Data is collected and analyzed to help validate or improve a design or decide on an optimal solution | Evaluate the strength of a conclusion that can be interpreted from any data set, using grade-appropriate mathematical techniques. | Conclusion  Optimal Solution |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | There is often more than one way to display data in order to identify and present significant features. | Utilize advanced techniques for displaying, analyzing and interpreting data (x-y scatter plots, cross tabulating, and statistics). | x-y Scatter Plots  Cross Tabulating  Statistics |  |  |
| **9-12** | In order to give meaning to their data, scientists and engineers organize and interpret it through tabulating, graphing, and statistical analysis. | In what ways are data analyzed and interpreted? | There is often more than one way to display data in order to identify and present significant features. | Analyze the performance of a design under a range of conditions. | Range of Conditions |  |  |
|  |  |  |  |  |  |  |  |
| **PreK-2** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | The identification of relationships in data is aided by a range of tools, including tables, graphs, and mathematics. | Use numbers to find or describe patterns. |  |  | S4.A.2.1 |
| **PreK-2** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Use simple instruments to measure variables that are best represented by a continuous numerical scale. | Graph  Numerical Scale |  | S4.A.2.1 |
|  |  |  |  |  |  |  |  |
| **3-4** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | The identification of relationships in data is aided by a range of tools, including tables, graphs, and mathematics. | Use numbers to find or describe patterns. | Pattern  Table  Graph |  | S4.A.2.1 |
| **3-4** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Use simple instruments to measure variables that are best represented by a continuous numerical scale. | Instruments  Scale  Data  Explanation  Model  Tools |  | S4.A.2.1 |
|  |  |  |  |  |  |  |  |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics is a language of science that allows for logical deduction. | Recognize dimensional quantities and use appropriate units. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics is a language of science that allows for logical deduction. | Express relationships and quantities in appropriate mathematical form. | Relationships  Logical Deduction |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Apply mathematics to interpolate values and to identify features such as maximum, minimum, range, average, and median. | Interpolate  Range  Average  Median  Maximum  Minimum |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Use symbols to represent data and predict outcomes. | Symbols  Graph  Data |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use simple test cases of mathematical expressions, computer programs, or simulations to see if they make sense. | Mathematical Expression  Simulation |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use computers to record measurements taken with computer-connected probes or instruments. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use computers for data analysis, using simple data sets. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **5-6** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics and computational thinking unite science and engineering. | Utilize mathematical relationships to build simple computer models, using appropriate supporting programs. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
|  |  |  |  |  |  |  |  |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics is a language of science that allows for logical deduction. | Recognize dimensional quantities and use appropriate units. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics is a language of science that allows for logical deduction. | Express relationships and quantities in appropriate mathematical form. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Apply mathematics to interpolate values and to identify features such as maximum, minimum, range, average, and median. | Interpolate  Range  Average  Median  Maximum  Minimum |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Use symbols to represent data and predict outcomes. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use simple test cases of mathematical expressions, computer programs, or simulations to see if they make sense. | Computational Tools |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use computers to record measurements taken with computer-connected probes or instruments. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use computers for data analysis, using simple data sets. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
| **7-8** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics and computational thinking unite science and engineering. | Utilize mathematical relationships to build simple computer models, using appropriate supporting programs. |  |  | S8.A.1.1  S8.A.1.3  S8.A.3.2 |
|  |  |  |  |  |  |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics plays an essential role in all aspects of inquiry. | Use symbols to represent data, predict outcomes, and derive further relationships. |  |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematics plays an essential role in all aspects of inquiry. | Utilize mathematical relationships to build simple computer models, using appropriate supporting programs or information and computer technology tools. |  |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Recognize that computer simulations are built on mathematical models that incorporate underlying assumptions about the phenomena or systems being studied. | Computer Simulation |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Mathematical tools and models guide and improve the posing of questions, graphing of data, constructing of explanations, and communicating of results. | Utilize appropriate units in scientific applications of mathematical formulas and graphs. | Mathematical Tools |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use technology and mathematics to improve investigations and communications. |  |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use computers for the collection, analysis, and display of data. |  |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use computer programs to transform data between various tabular and graphical forms to aid in the identification of patterns. |  |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational tools enable calculations that cannot be carried out analytically and allow for the development of simulations. | Use computers to record and display measurements taken with computer-connected probes or instruments. | Simulations |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Understanding the mathematics of probability and of statistically derived inferences is an important part of understanding science. | Apply mathematics to interpolate values and to identify features such as maximum, minimum, range, average, and median. | Interpolate  Range  Average  Median  Maximum  Minimum |  |  |
| **9-12** | Mathematics and computation tools are essential to science and engineering. | How are the tools of mathematics utilized in doing science? What are the benefits of mathematics for science? | Computational theories, informational and computer technologies, and algorithms allow scientists and engineers to search for distinct patterns and identify relationships and significant features. | Express relationships and quantities in appropriate mathematical or algorithmic forms for scientific modeling and investigations. | Scientific Model  Relationships  Significant Features |  |  |
|  |  |  |  |  |  |  |  |
| **PreK-2** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Solve design problems by appropriately applying scientific knowledge. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **PreK-2** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Offer causal explanations appropriate to their level of scientific knowledge. | Causal Explanations |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **PreK-2** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Use data to construct reasonable explanations of what is observed in an investigation. | Reasonable Explanation |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **PreK-2** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations must be open to questions and possible modifications. | Evaluate their own and others' work for consistency with the evidence. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
|  |  |  |  |  |  |  |  |
| **3-4** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Solve design problems by appropriately applying scientific knowledge. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **3-4** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Offer causal explanations appropriate to their level of scientific knowledge. | Scientific Theories |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **3-4** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Use data to construct reasonable explanations of what is observed in an investigation. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **3-4** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations must be open to questions and possible modifications. | Evaluate their own and others' work for consistency with the evidence. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
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| **5-6** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Solve design problems by appropriately applying scientific knowledge. |  |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Construct a device or implement a design solution. | Device |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Offer appropriate casual explanations based on scientific knowledge. | Causal Explanation |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Undertake design projects, engaging in all steps of the design cycle and producing a plan that meets specific design criteria. | Design Cycle |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Hypotheses can be used to predict what will happen in a given situation. | Develop descriptions, explanations, and predictions using evidence. | Hypothesis |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Hypotheses can be used to predict what will happen in a given situation. | Identify and isolate variables and incorporate the resulting observations into explanations of phenomena. | Variables  Hypothesis |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Hypotheses can be used to predict what will happen in a given situation. | Use measurements of how one factor does or does not affect another to develop causal accounts to explain observations. | Causal Account |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
|  |  |  |  |  |  |  |  |
| **7-8** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Solve design problems by appropriately applying scientific knowledge. | Scientific Explanation |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Construct a device or implement a design solution. |  |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Offer appropriate casual explanations based on scientific knowledge. | Causal Explanation |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Undertake design projects, engaging in all steps of the design cycle and producing a plan that meets specific design criteria. | Design Cycle |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Hypotheses can be used to predict what will happen in a given situation. | Develop descriptions, explanations, and predictions using evidence. |  |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Hypotheses can be used to predict what will happen in a given situation. | Identify and isolate variables and incorporate the resulting observations into explanations of phenomena. |  |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Hypotheses can be used to predict what will happen in a given situation. | Use measurements of how one factor does or does not affect another to develop causal accounts to explain observations. |  |  | S8.A.1.1  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
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| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Solve design problems by appropriately applying their scientific knowledge. |  |  |  |
| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Construct a device or implement a design solution. | Design Solution  Device |  |  |
| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations link scientific theory with specific observations or phenomena. | Apply a scientific theory to a novel situation. | Theory |  |  |
| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations often rely on physical and/or mathematical models or representations to explain phenomena. | Use mathematics or simulations to construct explanations for phenomena. |  |  |  |
| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Undertake design projects, engaging in all steps of the design cycle and producing a plan that meets specific design criteria. |  |  |  |
| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific theories are based in evidence, as well as historic and current scientific knowledge. | Undertake design projects, engaging in all steps of the design cycle and producing a plan that meets specific design criteria. | Design Criteria |  |  |
| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations must be open to questions and possible modifications. | Formulate and revise scientific explanations using logic and evidence. |  |  |  |
| **9-12** | Scientific theories are developed to provide explanations about the nature of particular phenomena, predicting future events, or making inferences about past events. | Why are theories valuable constructs in helping scientists understand and explain our world? | Scientific explanations must be open to questions and possible modifications. | Use primary and/or secondary scientific evidence and models to support or refute and explanatory account of a phenomenon. |  |  |  |
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| **PreK-2** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientific claims are based on evidence. | Construct an argument for an observed pattern. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **PreK-2** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Critical and continuous examination of ideas maintains scientific objectivity. | Evaluate and critique competing designs based on jointly developed and agreed-upon design criteria. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
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| **3-4** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientific claims are based on evidence. | Construct an argument for an observed pattern. | Scientific Claims |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
| **3-4** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Critical and continuous examination of ideas maintains scientific objectivity. | Evaluate and critique competing designs based on jointly developed and agreed-upon design criteria. |  |  | S4.A.1.1  S4.A.1.3  S4.A.2.1  S4.A.3.3 |
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| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientific claims are based on evidence. | Craft and defend with evidence a position about an observed phenomena. | Phenomena |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientific claims are based on evidence. | Distinguish between evidence and opinion. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Critique the elements of their own investigations in a logical manner and improve them in response to criticism. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Justify criticism of strengths and weakness of the components within an investigation. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Propose alternative explanations for the results of a scientific investigation. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Analyze aspects of investigative evidence as being significant for supporting or refuting an argument. | Argumentation |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Critical and continuous examination of ideas maintains scientific objectivity. | Defend the rationale for procedure, type of data collected, manner of collection, interpretation and conclusions of investigations. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists and citizens must evaluate media reports and claims. | Critically evaluate the scientific basis of media reported products, events and research. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists and citizens must evaluate media reports and claims. | Critically read media reports of science or technology so as to identify their strengths and weaknesses. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Argumentation is useful in resolving questions. | Recognize that the major features of scientific arguments are claims, data, and reasons. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Accurate and effective communication involves summarizing data, developing diagrams and charts, constructing a reasoned argument, and responding appropriately to critical comments. | Construct an argument based on deductive or inductive reasoning. | Data  Diagram  Chart  Inductive Reasoning |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
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| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientific claims are based on evidence. | Craft and defend with evidence a position about an observed phenomena. | Phenomena  Evidence |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientific claims are based on evidence. | Distinguish between evidence and opinion. | Evidence  Opinion |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Critique the elements of their own investigations in a logical manner and improve them in response to criticism. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Justify criticism of strengths and weakness of the components within an investigation. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Propose alternative explanations for the results of a scientific investigation. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists use reasoning and argumentation to support their claims and refute the claims of others. | Analyze aspects of investigative evidence as being significant for supporting or refuting an argument. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Critical and continuous examination of ideas maintains scientific objectivity. | Defend the rationale for procedure, type of data collected, manner of collection, interpretation and conclusions of investigations. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists and citizens must evaluate media reports and claims. | Critically evaluate the scientific basis of media reported products, events and research. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Scientists and citizens must evaluate media reports and claims. | Critically read media reports of science or technology so as to identify their strengths and weaknesses. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Argumentation is useful in resolving questions. | Recognize that the major features of scientific arguments are claims, data, and reasons. | Scientific Argument |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Accurate and effective communication involves summarizing data, developing diagrams and charts, constructing a reasoned argument, and responding appropriately to critical comments. | Construct an argument based on deductive or inductive reasoning. | Deductive Reasoning  Inductive Reasoning |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
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| **9-12** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Critical and continuous examination of ideas maintains scientific objectivity. | Explain how claims to knowledge are judged by the scientific community today, articulating the merits and limitations of peer review and the need for independent replication of critical investigation. | Peer Review |  |  |
| **9-12** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Critical and continuous examination of ideas maintains scientific objectivity. | Critically read media reports of science or technology so as to identify their strengths and weaknesses. |  |  |  |
| **9-12** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Accurate and effective communication involves summarizing data, developing diagrams and charts, constructing a reasoned argument, and responding appropriately to critical comments. | Communicate and defend a scientific argument using language appropriately, explaining statistical analyses, and speaking clearly and logically. | Scientific Reasoning  Statistical Analysis |  |  |
| **9-12** | Scientists must make critical judgments about their own work and that of their peers. | In what ways do scientists ensure the legitimacy of their work? | Arguments can be based on deductions from premises, on inductive generalizations of existing patterns, or on inferences about the best possible explanations. | Explain the nature of controversy in the development of a given scientific idea. |  |  |  |
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| **PreK-2** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Communicate observations through precise discussion, drawing and writing. | Diagram  Chart  Graph  Image  Symbol |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **PreK-2** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Apply scientific terms in specific contexts. | Diagram  Chart  Graph  Image  Symbol |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **PreK-2** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Writing reflectivity is an essential skill in reporting the events and interpretation of an investigation. | Write accounts of work including thoughts, ideas, models and illustrations | Model  Illustration  Investigation |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **PreK-2** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Writing reflectivity is an essential skill in reporting the events and interpretation of an investigation. | Craft written documents containing appropriate data displays that express an understanding of scientific ideas. | Scientific Idea |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **PreK-2** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in written or spoken form is a fundamental practice of science that requires scientists to describe observations precisely, clarify their thinking, and justify their arguments. | Freely engage in discussions with others about scientific investigations and observed phenomena. | Phenomena |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
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| **3-4** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Communicate observations through precise discussion, drawing and writing. |  |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **3-4** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Apply scientific terms in specific contexts. |  |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **3-4** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Writing reflectivity is an essential skill in reporting the events and interpretation of an investigation. | Write accounts of work including thoughts, ideas, models and illustrations |  |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **3-4** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Writing reflectivity is an essential skill in reporting the events and interpretation of an investigation. | Craft written documents containing appropriate data displays that express an understanding of scientific ideas. |  |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
| **3-4** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in written or spoken form is a fundamental practice of science that requires scientists to describe observations precisely, clarify their thinking, and justify their arguments. | Freely engage in discussions with others about scientific investigations and observed phenomena. |  |  | S4.A.1.3  S4.A.2.1  S4.A.3.1 |
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| **5-6** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Construct explanations of phenomena using knowledge of accepted scientific theory and link it to models and evidence. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Use primary or secondary scientific evidence and models to support or refute an explanation or phenomenon. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication occurs in a variety of formal venues. | Produce reports or posters that present their work to others. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | New technologies have extended communication practices. | Seek and use various forms of communication when discussing, presenting and evaluating scientific endeavors. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in written or spoken form is a fundamental practice of science that requires scientists to describe observations precisely, clarify their thinking, and justify their arguments. | Recognize the major features of scientific communication and produce written and illustrated texts or oral presentations that communicate individual ideas and accomplishments. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Scientists describe their investigations to the public in ways that enable others to repeat their investigations. | Orally present and defend the procedures, results and conclusions of investigations. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Public communication among scientists result in new knowledge and methods. | Critically read scientific information, including charts, diagrams, and tables commensurate with scientific knowledge and interpret the key ideas. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
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| **7-8** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Construct explanations of phenomena using knowledge of accepted scientific theory and link it to models and evidence. | Phenomena  Diagram  Chart  Graph  Image  Symbol |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in words, diagrams, charts, graphs, images, symbols and mathematics is a fundamental practice in science. | Use primary or secondary scientific evidence and models to support or refute an explanation or phenomenon. | Phenomena  Diagram  Chart  Graph  Image  Symbol |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication occurs in a variety of formal venues. | Produce reports or posters that present their work to others. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | New technologies have extended communication practices. | Seek and use various forms of communication when discussing, presenting and evaluating scientific endeavors. | Scientific Endeavor |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication in written or spoken form is a fundamental practice of science that requires scientists to describe observations precisely, clarify their thinking, and justify their arguments. | Recognize the major features of scientific communication and produce written and illustrated texts or oral presentations that communicate individual ideas and accomplishments. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Scientists describe their investigations to the public in ways that enable others to repeat their investigations. | Orally present and defend the procedures, results and conclusions of investigations. |  |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Public communication among scientists results in new knowledge and methods. | Critically read scientific information, including charts, diagrams, and tables commensurate with scientific knowledge and interpret the key ideas. | Diagram  Chart  Table |  | S8A.1.1  S8.A.1.2  S8.A.1.3  S8.A.2.1  S8.A.3.1  S8.A.3.2  S8.A.3.3 |
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| **9-12** | 8. Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Communication occurs in a variety of formal venues. | Produce reports or posters that present their work to others. |  |  |  |
| **9-12** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Science texts must be read so as to extract information accurately. | Engage in a critical reading of primary scientific literature or of media reports of science and discuss the validity and reliability of the data, hypotheses and conclusions. | Primary Scientific Literature  Validity  Reliability |  |  |
| **9-12** | Without the abilities to communicate findings accurately and persuasively or to learn about the findings of others, science cannot advance. | How do scientists communicate their work to others? | Science texts are multimodal, using a mix of words, diagrams, charts, symbols, and mathematics to communicate. | Recognize the major features of scientific communication and produce written and illustrated texts or oral presentations that communicate individual ideas and accomplishments. |  |  |  |